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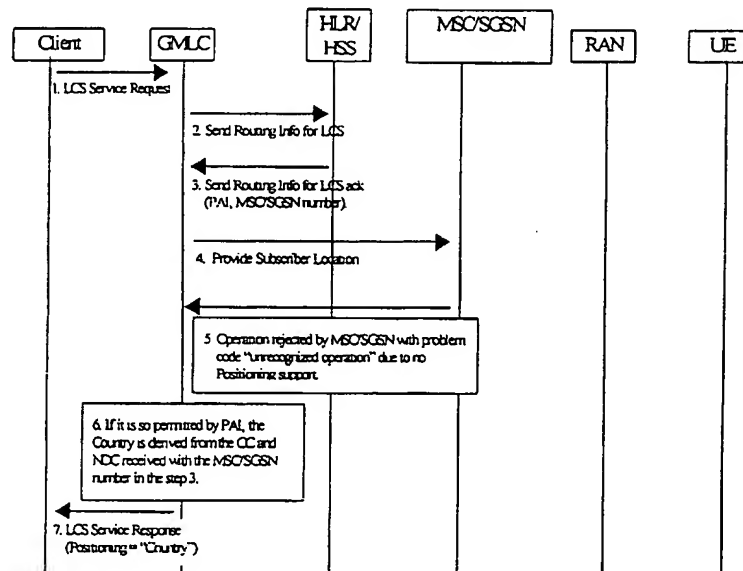
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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: SYSTEM FOR PROVIDING INFORMATION ABOUT THE LOCATION OF MOBILE USERS SUBSCRIBING TO A NETWORK AND ROAMING IN A DIFFERENT NETWORK NOT SUPPORTING THE SAME POSITIONING METHOD



(57) Abstract: In a system for providing location information for mobile users subscribing to a network of an operator and roaming in a different networks not supporting the same LoCation Services positioning feature as in the subscriber network, any kind of node and/or application accessing through a gateway the subscriber's network is provided with subscriber's location information based on the address - in terms of denomination of the geographical area pertaining to said different network - of the mobile switching center or the Visitor Location Register or the Serving GPRS Support Node.

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SYSTEM FOR PROVIDING INFORMATION ABOUT THE LOCATION OF MOBILE USERS SUBSCRIBING  
TO A NETWORK AND ROAMING IN A DIFFERENT NETWORK NOT SUPPORTING THE SAME  
POSITIONING METHOD

\* \* \* \*

The present invention relates to a new system which is able to provide location information about mobile users subscribing to the positioning feature with their operator and roaming in the network of a different or the same operator not supporting the same LoCation Services (LCS) positioning feature.

The invention can be applied to both GSM and UMTS technologies, and in the context of both Circuit Switch (CS) and Packet Switch (PS).

The standard architecture of the mobile positioning system is the one represented in fig. 1 of the appended drawings.

The Gateway Mobile Location Center (GMLC) implements functionalities required to support the Location Services LCS. In one network, there may be more than one GMLC. Each GMLC is the first node for the accesses of an external LoCation Services Client (LCS Client) in a mobile network. The GMLC may request routing information from a global register - Home Location Register (HLR) or Home Subscriber Server (HSS) - of the subscribers of the operator. Furthermore the GMLC contains information allowing to perform authentication and authorization activities of external LCS Client entities requiring location of mobile users. After having obtained the routing information and performed the authorization and authentication activities of the external LCS Clients, the GMLC sends the location request to the Mobile Switching Center/Visitor Location Register (MSC/VLR) or Serving GPRS Support Node (SGSN) and receives information about the geographic coordinates of the mobile user terminal whose location has been requested from the corresponding entities.

The HLR/HSS register contains all subscription user data, including the LCS subscription user data, and routing information. For a roaming mobile subscriber, the HLR/HSS may be in a network different from the one he is currently roaming into. In other words, should the user be roaming in the network of an operator different from the one he subscribes to, the HLR/HSS register is always the one of the operator the user subscribes to. The MSC/VLR or SGSN implements the functional activities for authorizing and handling location requests relating to the subscriber.

The system provides the opportunity of requesting the location of the mobile user terminals from an external LCS Client (Mobile Terminating Location Request=MT-LR), the location from the terminal itself (Mobile Originating Location Request=MO-LR) and the auto-induced location from network (Network Induced-Location Request=NI-LR).

In fig. 2 of the appended drawings a diagram of the main signalling between nodes is shown, in case of terminating positioning request.

According to the state of the art, when a mobile user, subscribing to an operator, is roaming in a network different from the one he is currently roaming into (in the same or in a different geographical area), which network does not support the same LCS positioning feature as in subscriber network, a terminating location request from an external LCS Client is not possible for this subscriber. In this case, the signalling flow will take place according to fig. 3 of the appended drawings and the operation will end with a failure.

The object of the present invention is to overcome, at least to a certain substantial extent, the above described serious problem.

To achieve that, the invention foresees that the home network LCS Client is provided with information relating to the geographical area in which the subscriber is located.

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drawings, in which:

fig. 1 is a block diagram representing the standard architecture of the mobile positioning system LCS according to the state of the art, already referred to;

figs 2 and 3 respectively show how, according to the state of the art, the main signalling takes place between nodes in case of a successful terminating location request and how, instead, said signalling does not allow to comply with the same request when a mobile user is roaming in a different network not supporting the same LCS positioning feature as in the subscriber network, both figures being already referred to in the above text; and

fig. 4 represents how, according to the invention, the main signalling flow between nodes of the system allows to obtain location information, in terms of denomination of the geographical area, also regarding a mobile user roaming in networks different from the one to which it subscribes and not supporting the same LCS positioning feature as in the subscriber network.

As already mentioned, according to the invention, any kind of node or application accessing through a gateway the subscriber network – node or application that can be defined as LCS Client external to the subscriber's network – is provided with location information of the subscriber itself based on the address of the mobile switching center MSC/VLR or SGSN, when the subscriber is roaming in a different network not supporting the same LCS positioning feature as in the subscriber network. Said address is provided in terms of denomination of the geographical area pertaining to said different operator.

In order to implement the invention, a new information is inserted in the HLR/HSS in the Subscriber LCS Privacy Profile (SLPP) and through this

new information the subscriber itself grants or refuses the authorization to provide a third party with its location in terms of denomination of the geographical area, in case of roaming in a different network not supporting the same LCS positioning feature as in the subscriber network. According to the invention, this information is transferred on the signalling interface L<sub>n</sub> (fig. 1) between the Home Location Register (HLR) or the Home Subscriber Server (HSS) and the Gateway Mobile Location Center (GMLC).

Suitably, in the GMLC a further subscriber LCS privacy check is added, based on the new information received, according to which the geographical information is provided or not externally to the network.

Of course, for an efficient operation of the system according to the invention, the external LCS Client must be arranged to receive the geographical information with an accuracy different from that required by it.

The main signalling flow between the nodes of the system according to the invention, in order to obtain location information in terms of geographical area, is represented in fig. 4 of the appended drawings.

When receiving the request from the external LCS Client, the GMLC asks the HLR/HSS a routing information, which is returned by the same HLR/HSS to the GMLC along with the new information regarding how to handle the location request, when the subscriber is roaming in a different network not supporting the same LCS positioning feature as in the subscriber network. This takes place through the SEND\_ROUTING\_INFO\_FOR\_LCS\_MAP message response.

In all cases where the MAP operation "PROVIDE\_SUBSCRIBER\_LOCATION" is rejected by the MSC/SGSN with the problem code "unrecognized operation", the GMLC checks if the new subscriber LCS privacy information, previously received by the Home Location Register (HLR) or the Home Subscriber Server (HSS), according to the invention,

allows the operator to use the location information in terms of denomination of the geographical area regarding the mobile user. If it is allowed, the Country Code (CC) and the Network Destination Code (NDC) from MSC/VLR or SGSN address received in response to the MAP message "PROVIDE\_SUBSCRIBER\_LOCATION" are translated into a text string corresponding to the relevant geographical area (e.g. Country) and sent to the external LCS Client. The external LCS Client will then be able to supply geographical information on the location of the mobile user of interest.

The invention also applies to the case in which the mobile user is roaming in a node of the subscriber network not supporting the same LCS positioning feature of the entity (GMLC) requesting the positioning information. In other words the system according to the invention concerns also the case in which the subscriber's home network and the different network in which the mobile user is roaming are different nodes of the same network.

The advantages attainable with the invention are apparent. First, said system makes the subscriber able to let suitably selected third parties to get informed about the geographical area where he is, even if he is roaming in a network not supporting the same LCS positioning feature of the network he subscribes to. Moreover, the service provider has the possibility to sell a new service (a positioning service different from the usual ones, relating to the geographical area), thus increasing its revenues.

The invention is provided for GSM or UMTS or GPRS network.

The invention comprises also a computer program loadable on a memory, adapted to perform the steps of the method described above.

### CLAIMS

1) A system for providing location information for mobile users subscribing to a network of an operator and roaming in a different network of a different or the same operator not supporting the same LoCation Services positioning feature as in the subscriber network, characterized in that any kind of node and/or application accessing through a gateway the subscriber's network is provided with subscriber's location information based on the address - in terms of denomination of the geographical area pertaining to said different network - of the Mobile Switching Center or the Visitor Location Register or the Serving GPRS Support Node.

2) A system according to claim 1) in which said node and/or application accessing through a gateway the subscriber's network is defined as an LCS Client.

3) A system according to claims 1) and 2) which provides a subscriber LoCation Services privacy information in the Home Location Register or in the Home Subscriber Server regarding the provisioning of said location information.

4) A system according to claim 1) and 2), which provides a subscriber LoCation Services privacy check in the Gateway Mobile Location Center regarding the provisioning of said location information.

5) A system according to claims 1) to 4) which provides a subscriber LoCation Services privacy information that can be accessed, activated and disactivated by the subscriber.

6) A system according to claims 1) to 5) in which said different network belongs to the same operator of the subscriber's network.

7) A system according to claims 1) to 5) in which said different network belongs to an operator different from the operator of the subscriber's home network.



8) A system according to claims 1) to 5) in which said subscriber's home network and said different network in which the mobile user is roaming, are different nodes of the same network.

9) A method for providing location information for mobile users subscribing to a network of an operator and roaming in a different network not supporting the same LoCation Services positioning feature as in the subscriber network, comprising:

- inserting in the Home Location Register or in the Home Subscriber Server in the Subscriber LoCation Services Privacy Profile a new information through which the subscriber grants or refuses the authorization to provide a third party with its location in terms of denomination of the geographical area, in case of roaming in a different network not supporting the same LoCation Services positioning feature as in the subscriber network;
- transferring this information on the signalling interface between the Home Location Register or the Home Subscriber Server and the Gateway Mobile Location Center;
- and adding in the Gateway Mobile Location Center a further subscriber LoCation Services privacy check based on the new information received, according to which the geographical information is provided or not externally to the network,
- the external LoCation Services Client (LCS Client) being arranged to receive the geographical information with an accuracy different from that required by it.

10) Method as claimed in claim 9) to be used in a GSM or UMTS or GPRS network.

11) Computer program loadable on a memory adapted to perform the steps of the method of claim 9).

- 1/3 -

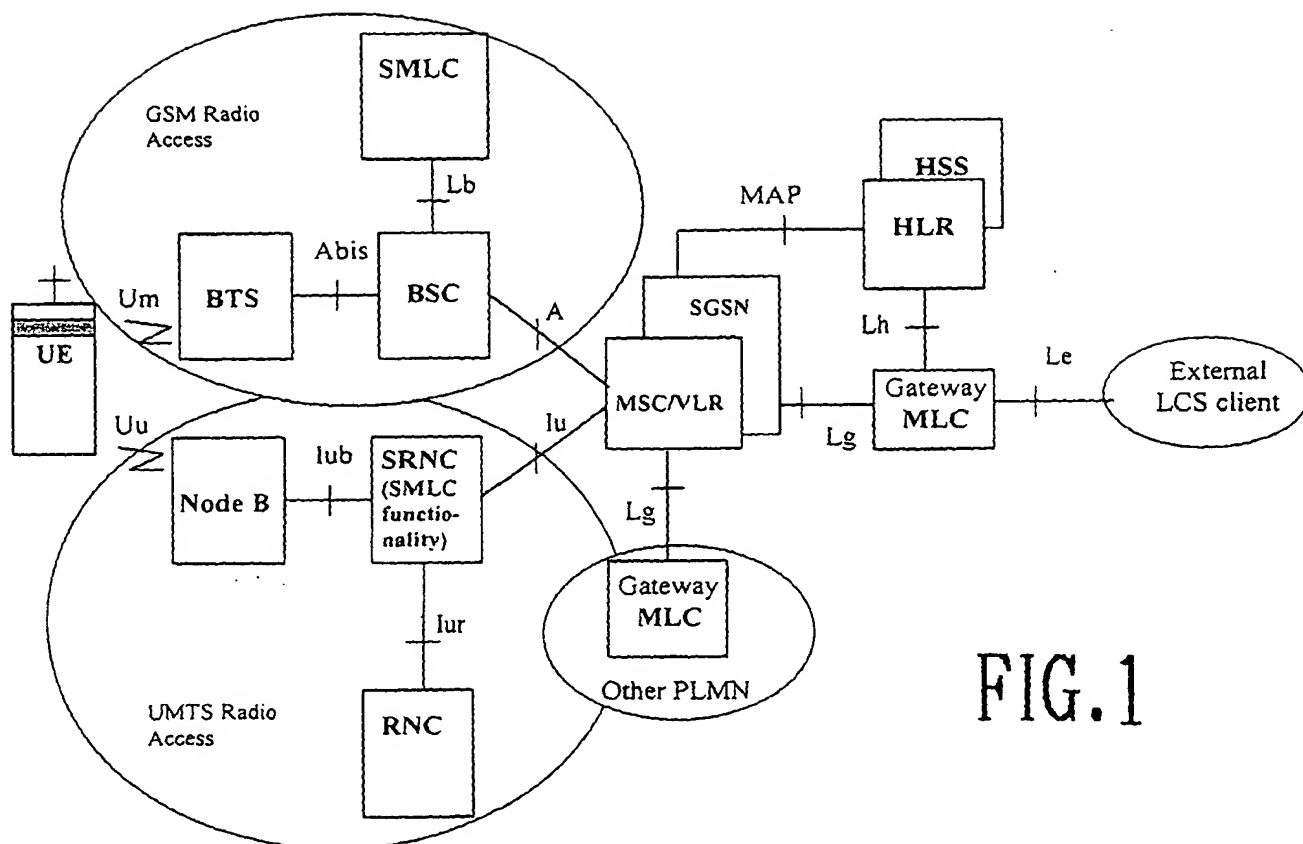


FIG.1

- 2/3 -

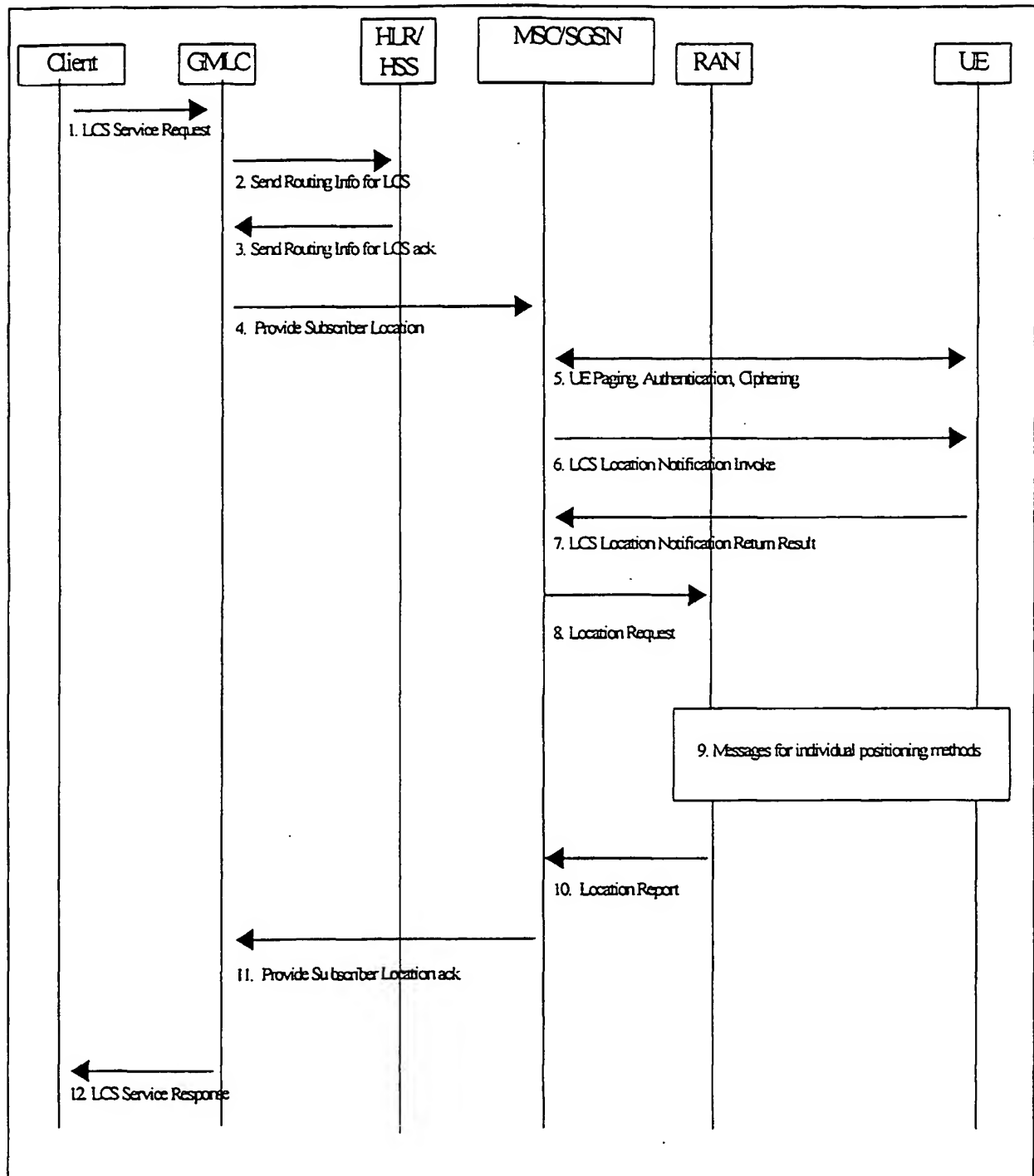


FIG.2

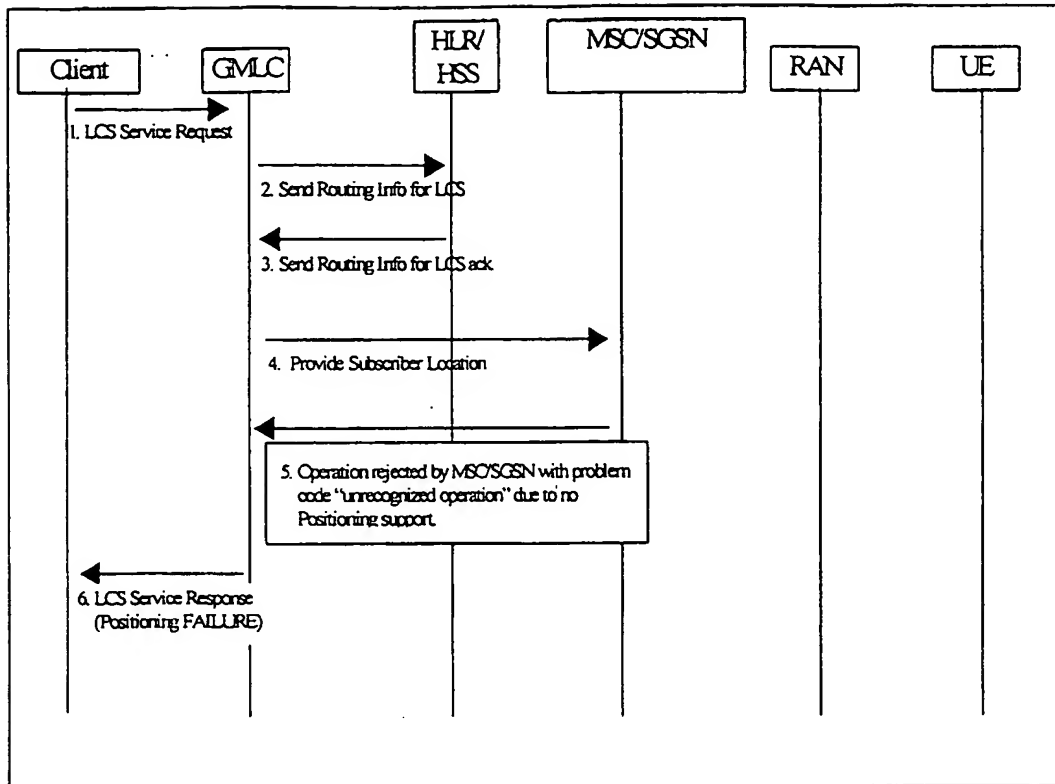


FIG. 3

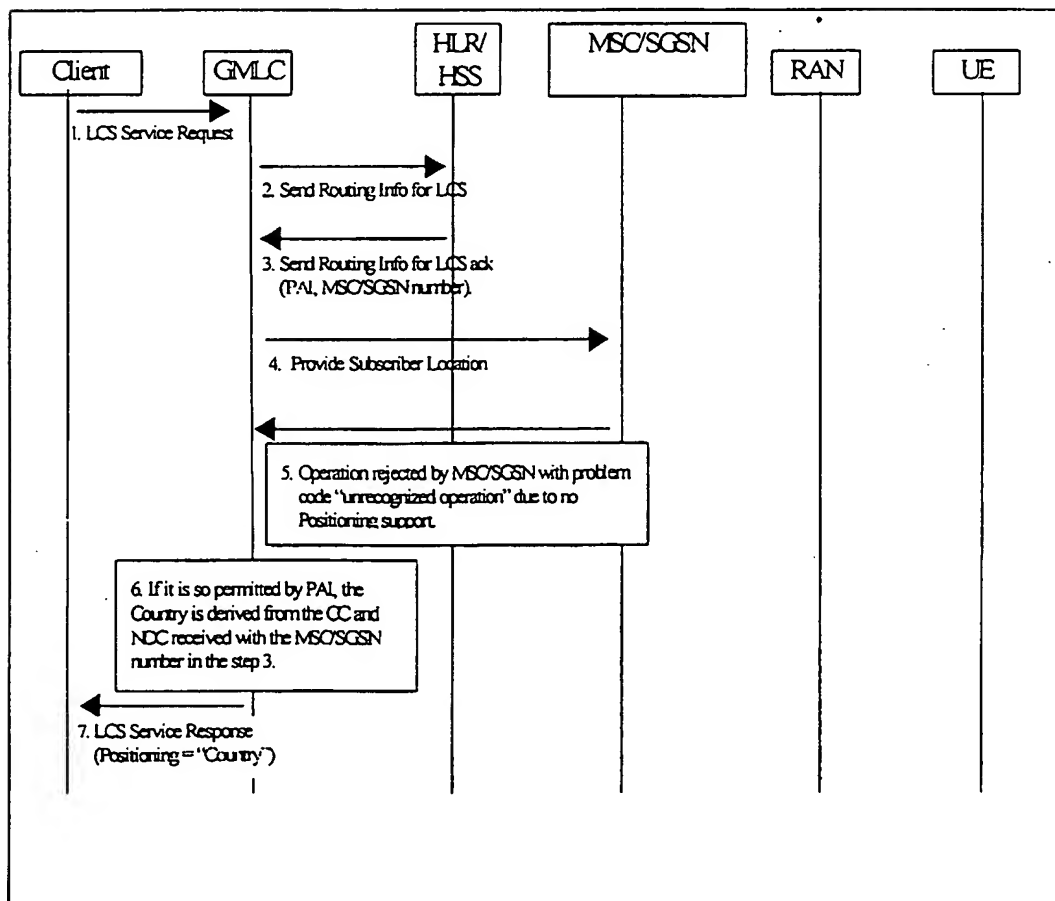


FIG. 4

**A. CLASSIFICATION OF SUBJECT MATTER**  
 IPC 7 H04Q7/38

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 H04Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EP0-Internal, WPI Data, PAJ, INSPEC

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	WO 97 24010 A (BELL COMMUNICATIONS RES) 3 July 1997 (1997-07-03) page 7, line 5 -page 8, line 17 ---	1-8
Y	US 2001/003093 A1 (LUNDIN MAGNUS) 7 June 2001 (2001-06-07) paragraph [0028] ---	1,2,6-8
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A	US 6 040 800 A (MOLNAR KARL ET AL) 21 March 2000 (2000-03-21) column 2, line 27-37 -----	1



Further documents are listed in the continuation of box C.



Patent family members are listed in annex.

## \* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&amp;" document member of the same patent family

Date of the actual completion of the international search

13 June 2002

Date of mailing of the international search report

04. 09. 2002

Name and mailing address of the ISA

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**Box I Observations where certain claims were found unsearchable (Continuation of Item 1 of first sheet)**

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:  
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:  
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:
3. ☐ Claims Nos.:  
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

**Box II Observations where unity of invention is lacking (Continuation of Item 2 of first sheet)**

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

1-8

**Remark on Protest**

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☐ No protest accompanied the payment of additional search fees.

## FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. Claims: 1-8

The problem is, that if the mobile terminal roamed into a system, this may not support the location services positioning feature as in the home network. Therefore the location information given as a reply to a request from a location service client is the (geographical address) of the serving MSC / VLR / SGSN.

2. Claims: 9-11

To maintain privacy of location information, a privacy check is performed in GMLC, client requesting location information receives reply with different accuracy than required

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